AIRFIELD PAVEMENT EVALUATION OPERATIONS PLAN

JULY 1998

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY
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CHAPTER I: INTRODUCTION

PURPOSE

The flying mission is the essential element of the Air Force's posture; however, sustaining flight is dependent upon each and every aspect of our force. One aspect is the ability of the pavement system to safely support sustained aircraft operations. With the advance of modern technology and strategic necessity, larger and heavier aircraft have become commonplace. Airfields must maintain adequate strength and friction characteristics to support frequent operations of aircraft loads. The Air Force has tasked Headquarters Air Force Civil Engineer Support Agency (HQ AFCESA) as the office of primary responsibility for evaluating and reporting airfield strength and friction characteristics. This operations plan introduces airfield pavement evaluations test methods, principles, equipment, and base support requirements.

EVALUATION FREQUENCY

Structural evaluations at most Air Force bases are conducted approximately once every ten years. Friction characteristic (skid) evaluations are conducted on an as needed basis. Base personnel should contact their MAJCOM pavements engineer to identify evaluation requirements.

CHAPTER II: STRUCTURAL EVALUATIONS

PURPOSE

The purpose of the Air Force Airfield Pavement Structural Evaluation Program is to obtain, compile, and report pavement strength and performance data on all airfields with present or potential use by the USAF. Pavement evaluation data provides operations and civil engineer functions with airfield pavement information that can be used to manage and control an airfield system. Results of pavement evaluation studies can be used to:

1. Determine sizes, types, gear configuration, number of passes, and gross weights of aircraft that can safely operate from an airfield without damage to the pavements or the aircraft.

2. Develop operations usage patterns for a particular airfield pavement system (e.g. parking plans, apron usage patterns, traffic flow, etc.).

3. Identify and predict major maintenance or repair requirements for an airfield pavement system to support present or proposed aircraft missions. When pavement rehabilitation is needed, the report can be used to furnish engineering data to aid in the project design.

4. Assist air base mission and contingency planning functions by compiling airfield layout and physical property data.

5. Develop and validate pavement system profile data.

6. Support programming documents that justify major pavement restoration projects.

TEST PROCEDURES

Evaluations consist of an in-brief, field work, and an out-brief.

1. In-Brief: The in-brief discusses the purpose of the evaluation, the field testing methods, base support requirements, and the report preparation process. The Base Civil Engineer (BCE), Pavement Engineer, and Horizontal Section Superintendent should attend as well as representatives from Base Operations, Air Traffic Control, Security Forces, Flight Safety, and other interested base organizations.
2. Field Work: The field work consists of three major elements: pavement inspection, pavement coring, and heavy weight deflectometer (HWD), electronic cone penetrometer (ECP), and/or dynamic cone penetrometer

(DCP) operations. Safety is a major consideration during the field work portion of the evaluation process. Therefore, evaluations will only be conducted during daylight hours.

(a) Pavement Condition Index (PCI) Survey: The pavement inspection is a review of the base PCI survey, which will be incorporated into the final airfield pavement report, and serves as a hands-on opportunity to become familiar with each pavement feature. This visual survey is not a detailed PCI as outlined in AFR 93-5 and ASTM D 5340-93; however, the rating scale is the same. The ratings are based on random counts of major distresses, combined with engineering judgment and AFR 93-5 as a guide.

(b) Pavement Core Drill: Typically a drill similar to the one in Figure 1 is used to extracted at least one pavement core from each airfield feature. Cores are used to verify pavement thickness, as stated in construction drawings and previous evaluations, and provide access to the underlying soil layers for sampling and testing. A typical base, requires 150 to 200 cores. The pavement coring and patching operation takes from 15 to 60 minutes per core location.

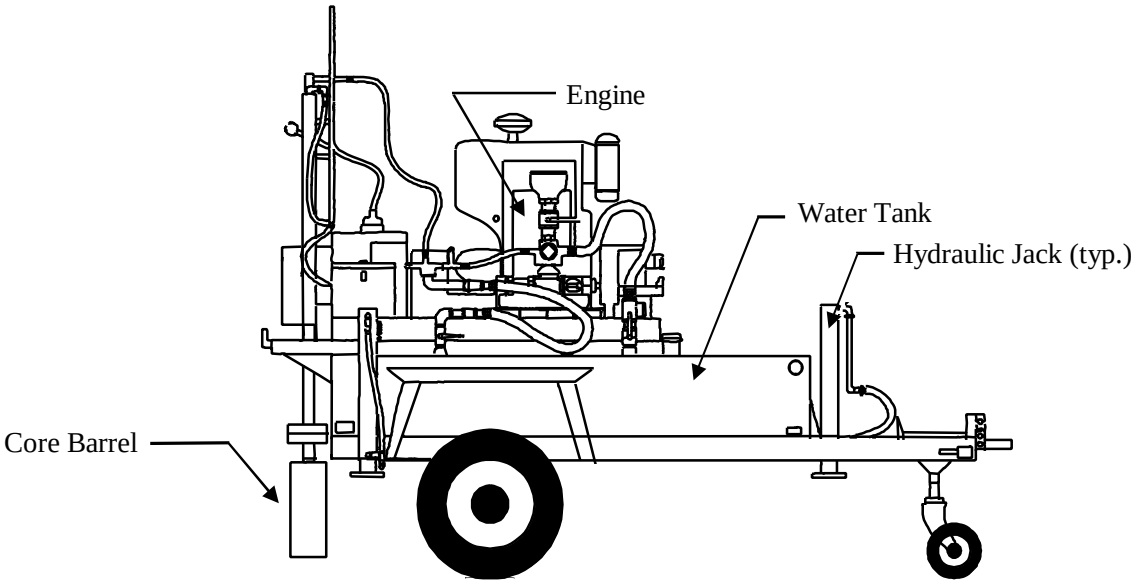


Figure 1--Pavement Core Drill

(c) Heavy Weight Deflectometer (HWD): The USAF uses a Dynatest 8081 HWD (illustrated in Figure 2) to conduct most routine structural pavement evaluations. The trailer mounted HWD can deliver a simulated 50,000 pound wheel load to the pavement system and record the pavement response (deflection basin) to the load. Results of HWD tests are used to determine the elastic modulus of the pavement layers. These moduli are used along with aircraft load and landing gear characteristics to determine the pavement

allowable gross loads (AGLs) and pavement classification numbers (PCNs) . Testing can be completed in two minutes at each drop location and typically 1,000 to 2,000 drops are required at a base.

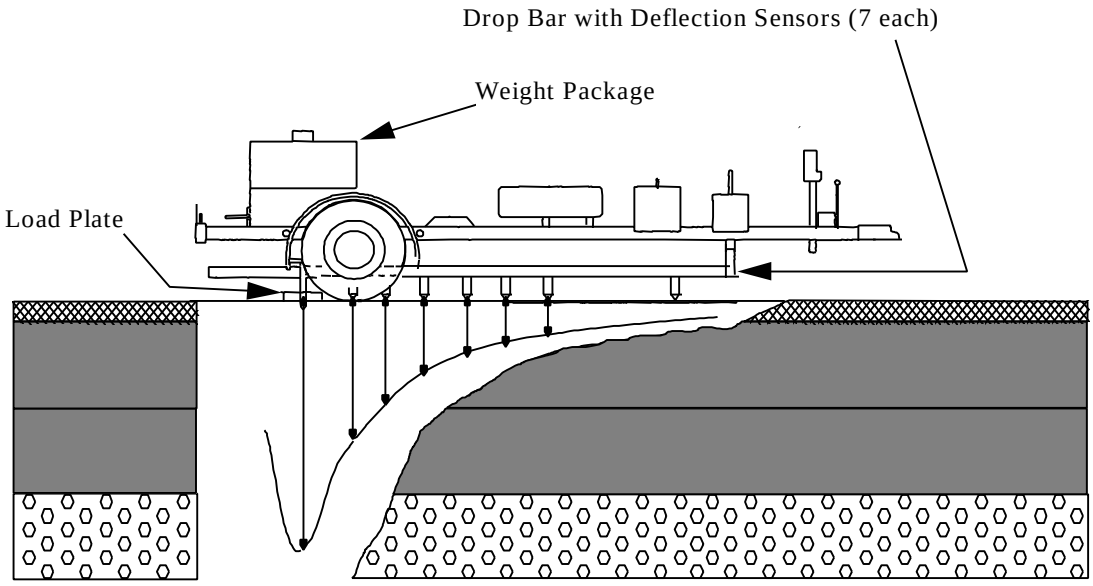


Figure 2--Heavy Weight Deflectometer

(d) Electronic Cone Penetrometer (ECP): The ECP is a soil investigation tool used to determine soil layer strength and thickness, illustrated in Figure 3. The electronic cone has two main elements the tip and sleeve. The tip measures the vertical force and the sleeve measures the horizontal resistance (friction) generated as the cone penetrates into the soil. These measurements also assist in classifying the soils according to the Unified Soil Classification System. The normal test procedure is to: (1) core the pavement, (2) center the ECP over the core hole, (3) then push the ECP in to the soil layers, and then patch the core hole. This process takes 30 to 75 minutes at each test. The usual depth of penetration below the pavement surface is approximately 6 feet.

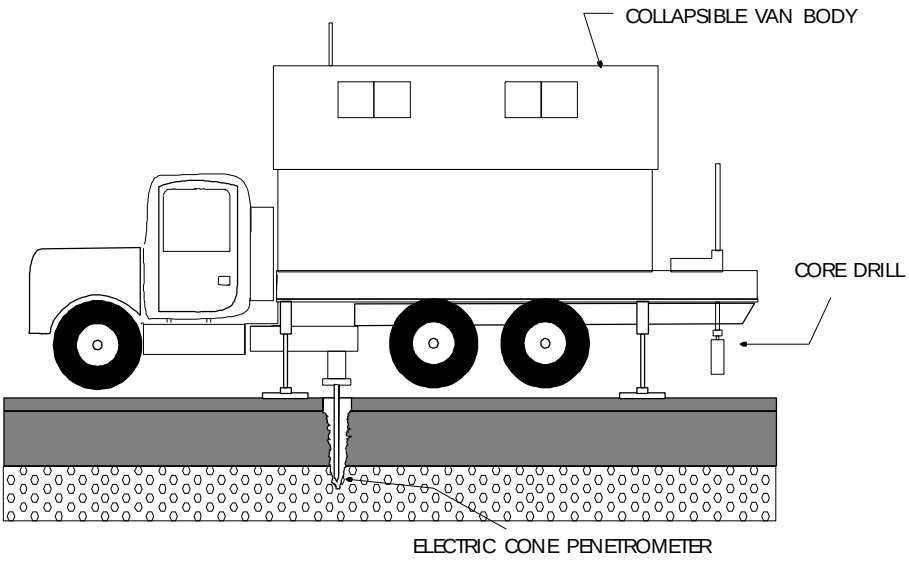


Figure 3--Electronic Cone Penetrometer

(e) Dynamic Cone Penetrometer (DCP): The DCP (illustrated in Figure 4) is used to determine soil layer strength and thickness. The DCP is operated by driving the cone tip into the soil layers with a 8 kilogram hammer dropped at a set height. By graphing blows vs depth, soil layer strength and thickness are determined.

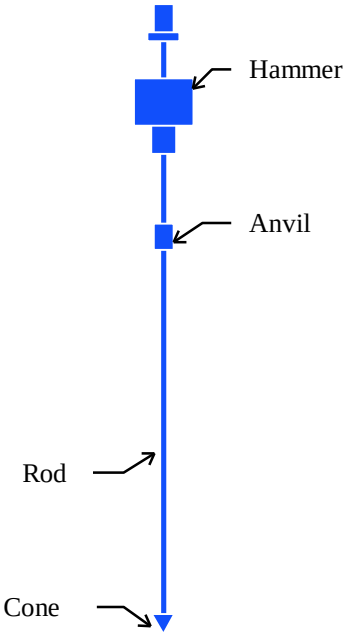


Figure 4--Dynamic Cone Penetrometer

SUPPORT REQUIREMENTS:

1. PCI Survey: Forward the most current Pavement Condition Index (PCI) survey for all airfield pavements to HQ AFCESA prior to the evaluation.

2. Construction history: Forward an electronic copy of an updated construction history to HQ AFCESA prior to the evaluation. The construction history file is a standard Microsoft Excel.xls file. Include a copy of the Base Layout Plan and "as-built" site plans with cross sections on all airfield pavement repair and/or construction projects accomplished since the last HQ AFCESA airfield pavement evaluation.

3. In-brief: Set up an in-brief to be held shortly (one-day) after team arrival. The Base Civil Engineer (BCE), Pavement Engineer, and Horizontal Section Superintendent should attend, as well as representatives from Base Operations, the Control Tower, Security Police, Flight Safety, and other interested base organizations. A conference room with a projector capable of projecting Microsoft Power Point briefings should be available. If it is not available then the HQ AFCESA team chief must be informed two weeks prior to team departure from Tyndall AFB. The following topics will be addressed:

(1) The field evaluation and report process.

(2) The support requirements listed in this operations plan.

4. Airfield Tour: Following the in-brief, a tour of the airfield should be scheduled for the pavement evaluation team, Airfield Manager, and Pavement Engineer. The tour will allow the team to become familiar with the airfield layout and provide base representatives an opportunity to identify any specific pavement problem areas.

5. Vehicles: The base will typically be requested to provide the vehicles below. Specific requirements will be coordinated with the HQ AFCESA Team Chief or Superintendent and the base project officer.

(1) A six passenger pickup truck with pintle hook mounted on the rear between 18 inches and 24 inches above the ground and capable of sustaining the 400 pound tongue weight and 6100 pound (loaded) gross weight of the core drilling trailer. *Note: This item is generally required for overseas and West Coast evaluation only. Check with the evaluation team superintendent for exact requirements.*

(2) A water truck with pump, driver, and radio to support coring operations throughout the airfield. NOTE: The driver and truck should stay with the coring operation, except to refill the water truck.

(3) A pavement sweeper truck with operator and radio.

(4) A van, station wagon, carryall, or six passenger pickup truck. The Team Chief will use this vehicle during the evaluation.

6. Airfield Access: The pavement evaluation team will require access to ALL airfield pavements, including those in controlled/restricted areas, for testing and photographing. Photograph clearance is required to photograph pavement distresses. Prior to team arrival, the base Project Officer will be provided the following information for all team members: name, rank, SSAN, security clearance, I.D. card number and restricted area badge number. This information should be used to complete a Entry Authorization List (EAL), typically prepared by the Security Police, for the duration of the team's stay.

7. Radios: Arrange for three hand held radios for the team at the in-brief. It is essential that the pavement evaluation team be able to maintain communications with the control tower, base operations, and the other team members.

8. AF Form 103: Coordinate a AF Form 103, Base Civil Engineering Work Clearance Request (Digging Permit), covering the airfield. The completed AF Form 103 should be provided to the team chief at the in-brief.

9. Equipment Storage: Arrange for a secure area, preferably clean, dry, and enclosed, for storage of pavement cores and test equipment (300 SF minimum with lighting and 110 volt outlet). Also, arrange for a secure parking area for AFCESA vehicles.

10. Shipment of Samples: Arrange for crating and shipping, to include funding citation, of pavement core samples and soil samples to HQ AFCESA/CESC, 139 Barnes Dr, Suite 1, Tyndall AFB FL 32403-5319. See attachment 3 for shipping crate construction details.

11. Fuel: Arrange for MOGAS/Diesel availability after normal duty hours including weekends. If fuel supply is available only during limited hours or at a distant location, also provide two clean gas cans (5 gallons each) with nozzle and key/credit card (if required). If required at the base, provide an approval letter to fill the 5 gallon gas cans.

12. Patch Crew: Typically a minimum of two personnel and material for 150-200 six-inch diameter core holes is sufficient to fill core holes during the

evaluation. The crew members must be available to work the same hours as the pavement evaluation team, be familiar with and certified for flightline vehicle operations, and have line badges for unescorted entry into restricted areas on the airfield. When possible, the same crew members should be available throughout the evaluation.

13. NOTAMs: Prepare and dispatch NOTAMs notifying air crews and the Air Traffic Control system of runway closures. Closure times should be at least eight consecutive hours for each runway. If longer closure periods are required due to unique base conditions or testing requirements, these periods will be addressed to the base Project Officer prior to the evaluation. Closure of other airfield areas, taxiways and aprons, are not usually required for our evaluation procedures.

14. Vehicle Maintenance: Contact vehicle maintenance to determine ability to repair TDY special purpose vehicles. Provide POC for maintenance during normal duty hours and after hours, including weekends.

CHAPTER III: FRICTION CHARACTERISTICS (SKID) EVALUATIONS

PURPOSE

The purpose of the Air Force Friction Characteristics Evaluation Program is to determine a runway surface's potential to contribute to a skidding or hydroplaning incident and make subsequent recommendations to reduce that potential.

1. The primary objectives of this evaluation are to:

a. Determine certain runway surface characteristics, such as slope and texture.

b. Conduct measurements of the runway surface coefficient of friction.

c. Assess the capability of the runway to drain excess water and recover its friction properties.

2. The results of this report can be used to:

a. Alert aircrews of the potential for skidding or hydroplaning problems through FLIP notices or other means.

b. Identify and program runway maintenance and repair requirements such as rubber removal and pavement texturing projects.

c. Support programming documents that justify major pavement restoration projects.

TEST PROCEDURES

A typical skid evaluation consists of an in-brief, field work, and an out-brief. The in-brief focus is primarily to review field test methods, coordinate support requirements for the evaluation, and provide a formal opportunity to discuss any specific concerns about the airfield pavement system with base personnel. The field work consists of three major elements: runway surface slope measurements, surface texture measurements, and friction measurements. The field work schedule is very flexible and work can be accomplished around a base’s flying schedule; however testing must be accomplished during daylight hours. Ideally, testing can be completed in six uninterrupted hours on a runway; however, at a minimum a two hour uninterrupted period is required to complete

the Mu-meter friction tests. The outbrief provides a formal opportunity to discuss preliminary findings that may require immediate action.

1. Slope Measurements: The slope measuring equipment consists of a 10 ft aluminum level fitted with an electronic module to measure slopes to the nearest 0.1 percent. Pavement surface transverse and longitudinal slopes are measured every 500 feet along the entire length of each runway. Transverse slopes are measured at 5 feet and 15 feet from the centerline, on both sides of the centerline. A single longitudinal slope is measured at the runway centerline. Note: These measurements are only spot checks of runway slopes. This survey does not describe a complete surface profile.

2. Surface Texture Measurements: A grease smear test is used to measure the texture depth of the pavement surface. The test equipment consists of 0.915 cubic inch (15 cc) of grease and a 4 in (10.16 cm) wide template in which the grease is evenly spread on the pavement surface. The volume of grease is then divided by the area of the smear to calculate the texture depth. Texture depth measurements are made at several locations on each runway surface to obtain a representative sampling of the pavement macrotexture.

3. Friction Measurements:

a. Continuous friction measuring equipment (CFME) is used to measure the runway surface friction. The CFME is equipped with a self-setting system to simulate rain-wetted pavement surface conditions.

b. Testing Modes:

(1) Self-Watering: Friction measurements are made along the entire runway length with the self-wetting CFME system at 40 and 60 mph. These measurements help to identify those areas of the runway pavement that are smooth due to poor texture, excessive traffic wear, aggregate polishing, and/or surface contaminants such as rubber deposits and oil/fuel spills.

(2) Runway Flooding: Runways may have different feature characteristics, such as depressed areas or texture changes, which may pond or hold excess water during periods of moderate to heavy rainfall. To measure this potential, the pavement texture is oversaturated and then the friction characteristics are measured to evaluate the runway's ability to drain excess water.

SUPPORT REQUIREMENTS

The following are general support requirements. The HQ AFCESA Team Chief will modify these as required.

1. Provide a general airfield layout diagram that is labeled with runway, taxiway, and parking apron designations. The diagram assists communications with the control tower.

2. The aircraft arresting system cables must be removed during the CFME tests and possibly during portions of the flood tests.

3. A water truck with pump and roll capability, a 1,500 gallon capacity, and a sustained pump flow rate of 300 gallons per minute must be provided with a driver and operator. Experience has shown that a P-18 is the easiest tanker to use. If a 1,500 gallon water truck is used, please have the nozzles removed from the spray bar and calibrate the flow rate without using extensions.

4. A hand held radio capable of communicating with the air traffic control tower must be provided to the evaluation team for use throughout the evaluation. If the water tanker does not have a built-in radio, a second hand held radio is required.

EVALUATION CHECKLIST

Please complete this form and provide it to the evaluation team upon arrival.

KEY PERSONNEL:

NAME	**PHONE**
Wing Commander	
_____	_____
Support Group Commander	
_____	_____
Operations Group Commander	
_____	_____
Base Civil Engineer	
_____	_____
Pavements Engineer	
_____	_____
Chief Of Operations	
_____	_____
Horizontal Section Superintendent	
_____	_____
Flying Safety Officer	
_____	_____
Airfield Manager	
_____	_____
Air Traffic Control Tower	
_____	_____
Vehicle Ops/Maint Officer	
_____	_____

SCHEDULED BRIEFINGS (IF NECESSARY):

In-Briefing

Date_____ Time_____

Place_____

Airfield Tour

Date_____ Time_____

Out-Briefing

Date_____ Time_____

Place_____

Scheduled Runway Closure:

Primary Closure

Date_____ Time_____

Alternate Closure

Date_____ Time_____

Attachment 1

FRICTION EVALUATION CHECKLIST

Note: Chapter III, paragraph C provides additional details to the checklist below.

1 Provide the HQ AFCESA POC the name, rank, phone number, and address of the base POC.

2 Confirm that the dates of the evaluation do not conflict with any major base exercise or event that would preclude adequate support or access to all airfield pavements.

3 Schedule an in-brief and outbrief.

4 Obtain a general airfield layout diagram with runway, taxiway, and parking apron designations. Provide this to the team chief at the in-brief.

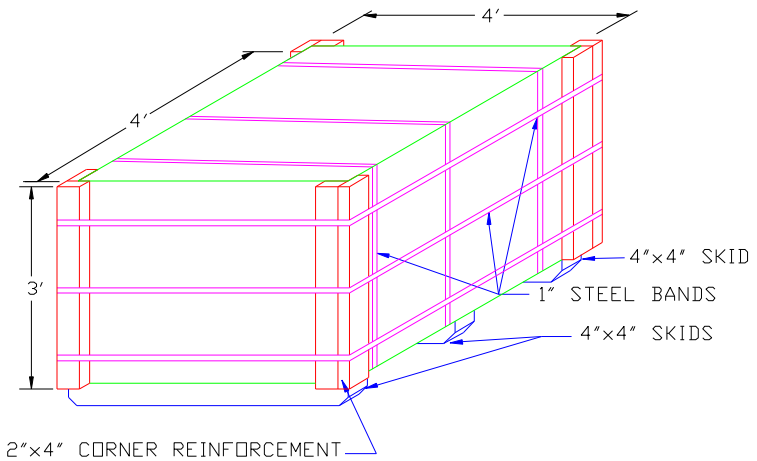
5 Coordinate to provide a water truck and operator with pump and roll capability. A 1,500 gallon capacity, and a sustained pump flow rate of 300 gallons per minute is required. Experience has shown that a P-18 fire truck is the easiest tanker to use

6 Arrange for the arresting systems to be removed during the CFME tests and possibly portions of the flood tests.

7 Provide the team chief with a hand held radio capable of communicating with the air traffic control tower.

Attachment 2

SHIPPING CRATE



Construction of Shipping Crate

1. All pavement core and soil samples are shipped to Tyndall AFB, Florida for laboratory analysis. To avoid damage, the samples must be protected by the shipping crate. Damaged samples are untestable.

2. The crate should be constructed of 3/4" plywood. Size is approximately 4' square by 3' high. 4"X4" skids are preferred for ease of forklift movement.

3. Crate Reinforcement:

   a. Bottom must be constructed to support approximately 5500 pounds.

   b. Corners must be reinforced with 2"X4" lumber.

   c. Sides must have three heavy duty steel bands equally spaced and three more must be installed top to bottom upon completion of airfield evaluation.

4. "NO" down sizing or substituting for the wood material; heavy duty cardboard will lose strength when wet. The possibility of samples shifting during shipment, especially in flight, could cause a major disaster.

5. This design complies with Air Freight regulations.

Attachment 3